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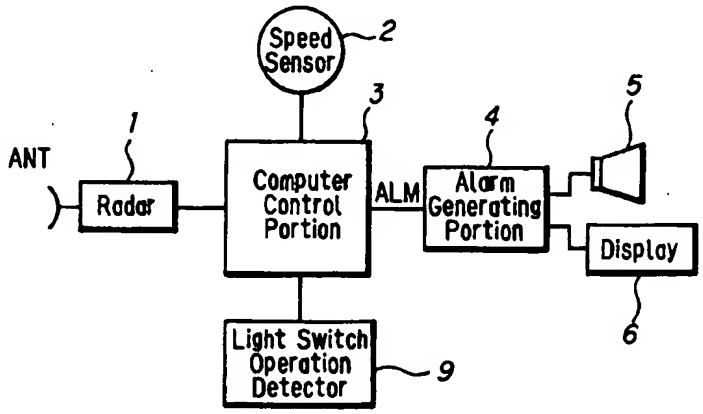
(54) Vehicle travel aiding device.

(57) A vehicle travel aiding device for sensing running conditions of the vehicle and outputting a vehicle travel supporting information, which is featured by detecting circumstances and road conditions for the vehicle and a driver's operation response and changing an outputting timing or a content of a supporting information according to the detection results.

FIG. 1



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Background of the Invention

The present invention relates to a vehicle travel aiding device for use in a vehicle, which is capable of sensing running conditions of the vehicle and generating travel aiding information such as an alarm for a short distance from a preceding vehicle, running guide and so on.

Japanese laid-open patent publication No. 60-91500 discloses such a vehicle travel aiding device that can always sense a distance from another vehicle running ahead of the vehicle the device serves and, when a measured distance becomes shorter than a proper intervehicular distance, produces an alarm and gives a command to make an automatic brake operate to keep the proper distance.

Japanese laid-open patent publication No. 62-81591 also discloses such a vehicle travel aiding device that can detect an objection ahead of the vehicle and produce an alarm when a distance from the objection becomes shorter than a specified value.

Japanese laid-open patent publication No. 4-290200 also discloses such a vehicle travel aiding device that can exchange data of driving conditions such as current position, running speed and running direction between other vehicles ahead and behind of the vehicle and issues an alarm when a danger of collision may arise therebetween.

Japanese laid-open patent publication No. 63-163210 discloses such a vehicle travel aiding device that determines a current location of the vehicle and indicates it along a preset travelling route on a road map indicated on a display screen and outputs a guiding instruction for turning to the right or the left at a crossing on the preset route when the vehicle is just passing a point at a specified distance from said crossing.

Problems involved in the above-mentioned prior arts devices are as follows:

A vehicle travel aiding information such as an alarm when sensing a dangerous approaching to another vehicle or a guiding instruction when approaching to a specified crossing is issued at a constant specified timing, neglecting the possible influence of circumstances. Such information, therefore, may not effectively help one to drive the vehicle, for example, in rain or night.

When a driver drives his vehicle on a super highway or a mountain road, he must be provided with correct and suitable information in consideration of concrete road conditions, which can not be provided by the prior art devices designed for only periodical generation of simple guiding data.

There is still such a problem that every driver may have his own response to an alarm on a short intervehicular distance and, therefore, the alarm issued at a fixed timing determined by a specified calculation may be too early or too late for one to operate the vehicle's accelerator or brake in correct time.

Summary of the Invention

Accordingly, an object of the present invention is to provide a vehicle travel aiding device for giving an information to help a driver to drive the vehicle according to detected conditions of a road on which the vehicle is running, which is capable of giving an aiding information at a correct timing that may adapt to surrounding brightness influencing the visibility of the driver of the vehicle: this is realized by using means for sensing a light switch operation mode and means for changing a timing of giving an aiding information according to a detected operation mode of the light switch.

Another object of the present invention is to provide a vehicle travel aiding device which is capable of changing a content of an aiding information according to a detected operation mode of a light switch.

Another object of the present invention is to provide a vehicle travel aiding device for giving an information to support a driver to drive the vehicle according to detected conditions of a road on which the vehicle is running, which is capable of giving an aiding information at an optimal timing that may vary depending upon weather influencing the visibility and other running conditions of the vehicle by using sensing means for sensing an operation mode of a wiper and control means for changing a timing of giving an aiding information according to a detected operation mode of the wiper drive.

Another object of the present invention is to provide a vehicle travel aiding device which is capable of changing a content of an aiding information according to a detected operation mode of a wiper drive.

Another object of the present invention is to provide a vehicle travel aiding device for giving an information to help a driver to drive the vehicle according to detected conditions of a road on which the vehicle is running, which is capable of giving an aiding information at an optimal timing that may be attained by judging the driver's ability on the basis of a measured response time of his operation to be aided by the device and by judging surrounding and running conditions of the vehicle.

Brief Description of the Drawings

Figure 1 is a construction block diagram of a vehicle travel aiding device embodying the present invention.

Figure 2 a flow chart showing a procedure of determining a status depending upon an operation mode of a light switch.

Figure 3 is a flow chart showing a procedure of producing an alarm by comparing a measured intervehicular distance with a corrected reference value depending upon an operation mode of a light switch.

Figure 4 is a construction block diagram of another vehicle travel aiding device embodying the present invention.

Figure 5 is a flow chart of procedure of determining a status of a vehicle depending upon an operation mode of a wiper switch.

Figure 6 is a flow chart showing a procedure of producing an alarm by comparing a measured intervehicular distance with a corrected reference value depending upon an operation mode of a wiper switch.

Figure 7 is a construction block diagram of another vehicle travel aiding device embodying the present invention.

Figure 8 is a construction block diagram of another vehicle travel aiding device embodying the present invention.

Description of the Preferred Embodiment

The preferred embodiments of the present invention will now be described in detail by way of example and with reference to the accompanying drawings.

Figure 1 shows an embodiment of a vehicle travel aiding device which gives an alarm by sensing a degree of approach of the vehicle to a preceding vehicle.

The vehicle travel aiding device comprises a radar 1 (e.g., a FM-CW type radar) for measuring a distance from a preceding vehicle and a relative running speed; a speed sensor 2 for detecting a running speed of the vehicle for which the device serves; a computer control portion 3 that determines a proper distance from the preceding vehicle by calculation from the relative running speed detected by the radar 1 and the running speed detected by the speed sensor 2, compares the current intervehicular distance with the determined proper (reference) distance and generates an alarm instruction signal ALM if the current distance is shorter than the calculated proper distance; and an alarm generating portion 4 that according to the alarm instruction signal ALM generates alarm on the short intervehicular distance by using a speaker 5 and a display 6. In Fig. 1, ANT designates a radar antenna.

The radar 1 senses a distance from a precedent vehicle and a relative running speed according to a known conventional method and the computer control portion 3 determines a proper intervehicular distance according to a known conventional method.

In the thus constructed device, an improvement according to the present invention is made to provide a light-switch operation detector 9 that detects which one of operation modes OFF, SMALL, LOW BEAM, HIGH BEAM is selected by a light-operation mode selecting switch to determine a status of brightness which may have an influence on a forward visibility of a driver of the vehicle and to provide control means that changes a timing of outputting an alarm instruction signal ALM.

When the light switch operation portion 9 detects the light switch set at OFF, the computer control portion 3 judges that the vehicle is running in the daytime, and gives the alarm instruction ALM at an ordinary timing when the detected distance from the preceding vehicle is shorter than the proper intervehicular distance determined according to a specified calculating procedure.

With the light switch detected at the SMALL position, the computer control portion 3 judges it is dim and gives the alarm instruction ALM at a timing advanced by one step, while with the light switch detected at the LOW BEAM position, the computer control portion 9 judges it is night or dark in a tunnel and gives the alarm instruction ALM at a timing advanced by two steps. With the light switch detected at the HIGH BEAM position, the computer control portion 3 judges it is pith-dark and gives the alarm instruction ALM at a timing advanced by three steps.

In practice, correction factors k1 for correcting a proper intervehicular distance at respective status levels 0 (OFF), 1 (SMALL), 2 (LOW BEAM) and 3 (HIGH BEAM) of the light switch are prepared as shown below in Table 1 and used for correction of a proper intervehicular distance determined by the same calculation procedure in such a way that-one of the correction factors is selected according to the present

operation mode of the light switch and a proper intervehicular distance L is multiplied by the selected correction factor to get a corrected proper distance value L' as shown below in an expression (1).

Table 1

STATUS	Correction Factors kl
0	1.0
1	1.1
2	1.2
3	1.3

$$L' = L * kl \quad (1)$$

where L' is a corrected proper intervehicular distance.

The correction factors are selected in such a way that a proper intervehicular distance that is determined on the condition that the light switch is set at OFF position may be increased by 1.1 times with the light switch set at SMALL, 1.2 times with the light switch at LOW BEAM and 1.3 times with the light switch at HIGH BEAM.

Figure 2 shows a flow chart for determining a status according to an operation mode of the light switch.

When the light switch is set at SMALL or LOW BEAM or HIGH BEAM position, the proper intervehicular distance is corrected to be correspondingly increased and, therefore, a timing of giving the alarm instruction ALM when an actual distance is shorter than the corrected proper distance may be correspondingly (step by step) advanced.

Figure 3 is a flow chart for generating an alarm by comparing the corrected proper intervehicular distance L' with a measured intervehicular distance ℓ.

In a vehicle travel aiding device (not shown) which can detect a distance from any obstruction (besides a preceding vehicle) ahead on a road by using an obstruction detecting radar and give an alarm when the detected distance from the obstruction is smaller than a specified threshold value, the present invention may be applied to enable the vehicle to sense a current operation mode SMALL or LOW BEAM or HIGH BEAM of a light switch and correct the threshold value to be correspondingly increased for the detected mode to stepwise change a timing of generating an alarm.

In a vehicle travel aiding device which can search and indicate a current location of the vehicle on a road map indicated on a display screen and give an instruction of turning to the right or the left when the vehicle is passing a point at a specified distance from a crossing existing ahead on a travelling course preset on the road map, the present invention may be applied to enable the vehicle to sense a current operation mode SMALL or LOW BEAM or HIGH BEAM of a light switch and correct the distance to the crossing to be correspondingly increased for the detected mode, thereby advancing a timing of giving said guiding instruction.

Besides changing a timing of issuing a vehicle travel aiding information, e.g., as an alarm on a short intervehicular distance or an obstruction and a travel guiding information according to an operation mode selected by the light switch, the present invention can also enable every device to judge there is no vehicle running ahead on a road when the light switch is set at HIGH BEAM (this judgment is made by the computer operation portion 3 of the shown embodiment) and switch off its radar for a while for saving its battery consumption and, furthermore, to change a content of aiding information when no coming-on vehicle under the same operation mode of the light switch.

Figure 4 shows an embodiment of a vehicle travel aiding device which is capable of outputting an alarm on approaching to a preceding vehicle and giving an instruction for driving an automatic brake.

The vehicle travel aiding device comprises a radar 1 (e.g., a FM-CW type radar) for measuring a distance from a precedent vehicle and a relative running speed; a speed sensor 2 for detecting a running speed of the vehicle for which the device serves; a computer control portion 3 that determines a proper distance from the preceding vehicle by calculation from the relative running speed detected by the radar 1 and the running speed detected by the speed sensor 2, compares the current intervehicular distance with the determined proper distance and generates an alarm instruction ALM and an automatic brake driving instruction BRK to keep a necessary intervehicular distance if the current distance is shorter than the

calculated proper distance; an alarm generating portion 4 that, according to the alarm instruction signal ALM, generates an alarm on the short intervehicular distance by driving a speaker 5 and an display 6; and an actuator 7 for driving a brake driving device 8 according to the automatic brake driving instruction BRK. In Fig. 4, ANT designates a radar antenna.

In the thus constructed device, an improvement according to the present invention is made to provide a wiper-switch operation detector 10 for detecting which one of operation modes PERIODICAL, SLOW and FAST is selected by a wiper-operation mode switch and determining a status of weather which may have an influence on a forward visibility of a driver and running condition of the vehicle (for example, a braking distance is an object to control), and computer control means 3 for changing a timing of outputting an alarm instruction ALM and an automatic brake driving instruction BRK according to the detected operation mode of the wiper switch.

When the wiper switch operates periodically, the device judges it is drizzling and advances by one step a timing of giving the alarm information ALM and an automatic brake driving instruction BRK. When the wiper is moving slowly, the device judges it is lightly raining and, therefore, advances by two steps a timing of giving the alarm instruction ALM and a braking instruction BRK. When the wiper is moving fast, the device judges it is raining heavily and, therefore, advance by three steps a timing of giving the alarm instruction ALM and a braking instruction BRK.

In practice, correction factors k2 for a proper intervehicular distance at respective statuses 0 (OFF), 1 (PERIODICAL), 2 (SLOW) and 3 (FAST) of the wiper switch are prepared as shown below in Table 2 and used for correction of a proper intervehicular distance determined by the same calculation procedure in such a way that one of the correction factors is selected according to the present operation mode of the wiper switch and the proper intervehicular distance value L is multiplied by the selected correction factor k2 to get a corrected reference distance value L'' as shown below in an expression (2).

Table 2

STATUS	Correction Factors k2
0	1.0
1	1.1
2	1.2
3	1.3

$$L'' = L * k2 \qquad (2)$$

where L'' is a corrected proper intervehicular distance.

The correction factors are selected in such a way that the proper intervehicular distance determined when wiper does not move may be increased by 1.1 times when the wiper operating PERIODICALLY, 1.2 times when the wiper operating SLOWLY and 1.3 times when the wiper operating FAST.

Figure 5 shows a flow chart for determining a status according to an operation mode of the wiper switch.

When the wiper operates periodically (status 1) or slowly (2) or fast (3), the proper intervehicular distance is corrected to be correspondingly increased and, therefore, a timing of giving the alarm instruction ALM and the automatic brake driving instruction BRK when an actual distance is shorter than the corrected proper distance may be correspondingly (step by step) advanced.

Figure 6 is a flow chart for generating an alarm by comparing an actually measured intervehicular distance ℓ with the corrected proper intervehicular distance L''.

In a vehicle travel aiding device (not shown) which can detect a distance from any obstruction (besides a preceding vehicle) ahead on a road by using an obstruction detecting radar and give an alarm when the detected distance from the obstruction is smaller than a specified threshold value, the present invention may be applied to enable the vehicle to sense a current operation mode PERIODICAL or SLOW or FAST of a wiper switch and to correct the threshold value to be correspondingly increased for the detected mode, thereby stepwise changing a timing of generating an alarm.

In a vehicle travel aiding device which can search and indicate a current location of the vehicle on a road map indicated on a display screen and give an instruction of turning to the right or the left when the

vehicle is passing a point at a specified distance from a crossing existing ahead on a travelling course preset on the road map, the present invention may be applied to enable the vehicle to sense a current operation mode PERIODICAL or SLOW or FAST of a wiper switch and to correct the distance to the crossing to be correspondingly increased for the detected mode, thereby advancing a timing of giving the guiding instruction.

Besides changing a timing of issuing a vehicle travel aiding information such as an alarm on a short intervehicular distance or an obstruction and a travel guiding information according to an operation mode selected by the wiper switch, the present invention can also enable every vehicle to stepwise lower a response of an accelerator and a response of a steering handle for an driver's operation amount exceeding the specified value by using respective adjusting means for preventing slippage of the vehicle in a rainy day at an emergency braking or steering.

It is also possible to stepwise increase loudness of an audio alarm on a short intervehicular distance or of a guiding speaker according to respective operation modes of the Wiper switch to assure the necessary loudness in a rainy day, especially in heavy rain.

Figure 7 shows an embodiment of a vehicle travel aiding device which is capable of outputting an alarm on approaching to a preceding vehicle and giving an instruction for operating an automatic brake.

The vehicle travel aiding device comprises a radar 1 (e.g., a FM-CW type radar) for measuring a a distance from a preceding vehicle and a relative running speed; a speed sensor 2 for detecting a running speed of the vehicle for which the device works; a computer control portion 3 (intervehicular distance alarm control portion 31) that determines a proper distance from the preceding vehicle by calculation from the relative running speed detected by the radar 1 and the running speed detected by the speed sensor 2, compares the current intervehicular distance with the determined proper distance and generates an alarm instruction ALM when the detected current distance becomes shorter than the calculated proper distance; an alarm generating portion 4 that, according to the alarm instruction signal ALM, generates an alarm on the short intervehicular distance by driving a speaker 5 and a display 6 and an actuator 7 of a brake driving device 8 according to the automatic brake driving instruction BRK. In Fig. 7, ANT designates a radar antenna.

In the device thus constructed, an improvement according to the present invention is made by providing the computer control portion 3 with sensing means for sensing braking operation for which the intervehicular distance alarm aid is made, means for judging a response of a driver by measuring a duration from the time of issuing an alarm to the time of detecting a braking operation, means for detecting circumstances of the vehicle, means for sensing road conditions and means for changing a timing of outputting an alarm instruction ALM and a automatic brake driving instruction BRK according to the detected response of the driver, circumstances and road conditions.

In practice, as shown in Fig. 7, a brake operation detector 11 detects that a brake pedal of the vehicle has just been stepped on and a response discriminator 32 of the computer control portion 3 measures a time from the moment of issuing an alarm to the moment of detecting a braking operation by using a timer 33. The response discriminator 32 discriminates a responding state of the driver by averaging the measured values and generates an instruction for changing an alarm outputting timing according to the determined responding state of the driver and transfers it to an intervehicular distance alarm control portion 31 that in turn outputs an alarm instruction ALM and automatic brake driving instruction BRK at a suitable timing.

When a response time of, e.g. , 1.2 seconds is taken as a standard, the response discriminator 32 judges a driver response is fast or late if a measured response time is not more than 1.0 second or not less than 1.4 seconds and gives a timing change instruction to the intervehicular distance alarm control portion 31 so that the portion may output an alarm instruction ALM and an automatic brake driving instruction BRK at a timing delayed or advanced by a specified value.

The intervehicular distance alarm control portion 31 has prepared correction factors that may decrease and increase a basically calculated proper intervehicular distance by 20 percent and the other respectively at fast and slow response of the driver. The intervehiclular distance alarm control portion 31 corrects the basically calculated proper intervehicular distance by multiplying by a correction factor selected according to the instruction received from the response discriminator 32.

As shown in Fig. 7, a wiper switch operation detector 10 detects a "periodical" or "slow" or "fast" operation mode selected by the wiper switch and a circumstance discriminator 34 of the computer control portion 3 judges weather having an influence on the visibility and running conditions of the vehicle according to the detected wiper-operation-mode and gives the intervehicular distance alarm control portion 31 an instruction for changing an output timing.

When the wiper switch operates periodically, the circumstance discriminator 34 judges it is drizzling and gives an output-timing change instruction to the intervehicular distance alarm control portion 31 to

advance by one step a timing of giving the alarm information ALM and an automatic brake driving instruction BRK. When the wiper is working slowly, the device judges it is raining lightly and gives an output-timing change instruction to advance by two steps a timing of giving the alarm information ALM and a automatic brake driving instruction BRK. When the wiper is moving fast, the device judges it rains heavily and generates an output-timing change instruction to advance by three steps a timing of giving the alarm instruction ALM and a automatic brake driving instruction BRK.

The intervehicular distance alarm control potion 31 has preset correction factors usable for increasing the calculated proper intervehicular distance by 10 percent at the periodical operation mode of the wiper, 30 percent at the slow operation mode and 50 percent at the fast operation mode. This alarm control portion 31 corrects the calculated intervehicular distance by multiplying by a correction factor selected according to an instruction received from the circumstance discriminator 34.

This feature makes it possible to stepwise discriminate weather by detecting a selected operation mode of the wiper without using a rainfall sensor.

As shown in Fig. 7, a light switch operation detector 9 detects a "small" or "low beam" or "high beam" operation mode selected by the wiper switch and the circumstance discriminator 34 of the computer control portion 3 judges spatial brightness having an influence on a visibility and running conditions of the vehicle according to the detected operation mode of a light switch and gives the intervehicular distance alarm control portion 31 an instruction for changing an output timing.

With the light switch detected at the SMALL position, the circumstance discriminator 34 of the computer control portion 3 judges it is dim and instructs the intervehicular distance alarm control portion 31 to advance its alarm output timing by one step, while with the light switch detected at the LOW BEAM position, the circumstance discriminator 34 judges it is night or dark in a tunnel and instructs the intervehicular distance alarm control portion 31 to advance its alarm output timing by two steps. With the light switch detected at the HIGH BEAM position, the circumstance discriminator 34 judges it is pith-dark and instructs the intervehicular distance alarm control portion 31 to advance its alarm output timing by three steps.

The intervehicular distance alarm control potion 31 has preset correction factors usable for increasing the calculated proper intervehicular distance by 10 percent at the SMALL operation mode of the wiper, 30 percent at the LOW BEAM operation mode and 50 percent at the HIGH BEAM operation mode. This alarm control portion 31 corrects the calculated intervehicular distance by multiplying by a correction factor selected according to an instruction received from the circumstance discriminator 34.

This feature makes it possible to stepwise discriminate weather by detecting a selected operation mode of the wiper without using a brightness sensor.

As shown in Fig. 7, a handle operation detector 12 detects an steering angle exceeding a specified value by using a steering angle sensor or direction sensor and generates a handle operation detection signal which is transferred together with detection signals of the speed sensor 2 and the brake operation detector 11 to a road condition discriminator 35 of the computer control portion 3 that in turn judges what kind of a road, e.g., a mountain road or a superhighway the vehicle is running on the basis of the received detection signals and instructs the intervehicular distance alarm control portion 31 to change its output timing.

In practice, the road condition discriminator 35 determines a handle operation frequency for a specified travel distance from handle operation detection signals and examines whether the determined value exceeds a given threshold, determines a brake operation frequency for a specified travel distance from brake operation detection signals and examines whether the determined value exceeds a given threshold or not and, then, determines an average running speed of the vehicle from speed detection signals and examines whether the determined value exceeds a given threshold.

When both the handle operation frequency and the brake operation frequency exceed the respective thresholds, the road condition discriminator 35 judges the road to be a mountain road and instructs the intervehicular distance alarm control portion 31 to output an alarm instruction ALM and an automatic brake driving instruction BRK at a timing advanced by a specified corresponding step value.

When the brake operation frequency is low and the average speed exceeds the given threshold, the road condition discriminator 35 judges the road to be a superhighway and instructs the intervehicular distance alarm control portion 31 to outputs an alarm instruction ALM and an automatic brake instruction BRK at a timing advanced by a specified corresponding step value.

The intervehicular distance alarm control portion 31 has a preset correction factor usable for increasing the calculated proper intervehicular distance by 20 percent in case of the road being a mountain road or a superhighway and corrects the calculated intervehicular distance by multiplying by a correction factor selected according to the instruction received from the road condition discriminator 35.

As a basically calculated proper intervehicular distance is thus corrected according to the respective discrimination results as to the diver's response, circumstances and road conditions, a timing of giving an alarm instruction ALM and an automatic brake driving instruction BRK, which is determined based on the result of comparison of an actually detected intervehicular distance with a corrected proper distance, can be correspondingly changed.

Table 3 shows correction factors to be used for correcting a basically calculated proper intervehicular distance according to the driver's response, circumstances and road conditions.

Table 3

Response	Fast 0.8 (decreased by 20%)	Slow 1.2 (increased by 20%)	
Weather	Drizzling 1.1 (increased by 10%)	Light Rain 1.3 (increased by 30%)	Heavy Rain 1.5 (increased by 50%)
Brightness	Dim 1.1 (increased 10%)	Dark 1.2 (increased by 20%)	Pitch-dark 1.5 (increased by 50%)
Road Conditions	Mountain road 1.2 (increased by 20%)	Highway 1.2 (increased by 20%)	

The intervehicular distance alarm control portion 31 synthetically examines output-timing change instructions separately received from the response discriminator 32, the circumstance discriminator 34 and the road condition discriminator 35, performs calculations according to a given procedure and finally decides a timing of issuing an alarm instruction ALM and automatic brake driving instruction BRK in the following manner:

For example, when a vehicle is driven by a driver having a fast response (corresponding to a correction factor of -20%) in a heavy rain (a factor +50%) at night (a factor +20%), a basically calculated proper intervehicular distance is increased by 50%(-20 † 50 † 20), thereby a timing of outputting an alarm instruction ALM and an automatic brake driving instruction BRK is advanced by 50% in comparison with an ordinary timing. When the vehicle is driven by the driver having a fast response (-50%) on a mount road (+20%) in a fine day, the proper intervehicular distance is not changed (-20% † 20% = 0%), thereby an alarm instruction ALM and an automatic brake operation instruction BRK are outputted at the ordinary timing. Other cases are processed in the similar way as the abovementioned examples.

Figure 8 shows another embodiment of the present invention, which further includes an accelerator operation detector 14 and, similarly with the afore-described embodiment, a response discriminator 32 judges a response ability of a driver by measuring a time interval between the moment of issuing an alarm instruction ALM to the moment of releasing an accelerator, determines an accelerator operation frequency for a specified running distance from detection signals from the accelerator operation detector 14 and examines whether the determined frequency exceeds a given threshold value or not.

In this embodiment, the intervehicular distance alarm control portion 31 gives an engine output control instruction EOC to an engine output control unit to forcibly reduce rotations of the vehicle's engine (instead of automatic braking instruction) at the time of issuing an intervehicular distance alarm.

In a vehicle travel aiding device (not shown) which can detect a distance from any obstruction (besides a preceding vehicle) ahead of the vehicle on a road by using an obstruction detecting radar and give an alarm when the detected distance from the obstruction is smaller than a specified threshold value, the present invention may be applied to enable the device to synthetically estimate results of discrimination of a driver's response, circumstances and road conditions and corrects the threshold value to optimally changing a timing of generating an alarm.

In a vehicle travel aiding device which can search and indicate a current location of the vehicle on a road map indicated on a display screen and give an instruction of turning to the right or the left when the vehicle is passing a point at a specified distance from a crossing existing ahead on a travelling course preset on the road map, the present invention may be applied and enable the device to synthetically estimate results of discrimination of a driver's response ability, circumstances and road conditions and correct the threshold value to optimally change a alarm generating timing.

As described above, the present invention provides a vehicle travel aiding device for generating a vehicle travel aiding information such as an alarm on a short distance from another vehicle to assure safe travelling, a guiding instruction at a crossing and so on, which can stepwise senses a degree of surrounding

brightness (darkness) influencing the visibility of sight ahead of the vehicle by detecting an operation mode selected by a light switch (without using any brightness sensor and A-D converter) and output a supporting information at an optimal timing or with an optimal content according to the detection result.

The present invention provides a vehicle travel aiding device for generating a vehicle travel supporting information such as an alarm on a short distance from another vehicle to assure safe travelling, a guiding instruction at a crossing and so on, which can stepwise senses weather conditions influencing the visibility of sight ahead of the vehicle by detecting a wiper operation mode (without using any rainfall sensor and A-D converter) and output a supporting information at an optimal timing or with an optimal content according to the detection result.

The present invention provides a vehicle travel aiding device for detecting running conditions of the vehicle and generating a vehicle travel aiding information such as an intervehicular distance alarm and other travel guiding information according to the detected conditions, which can judge a driver's responding ability by measuring a response time of his operation, discriminate a degree of separately detected circumstances and road conditions and change a timing of outputting every supporting information based on a synthetic judgment of the discrimination results, thereby issuing the supporting information at an optimal timing with due consideration of the driver's ability, circumstances and road conditions.

Claims

1. A vehicle travel aiding device for sensing running conditions of a vehicle and outputting a vehicle travel supporting information, comprising means for detecting an operation mode selected by a light switch and control means for changing a timing of outputting the travel supporting information according to the detected operation mode of the light switch.

2. A vehicle travel aiding device according to Claim 1, characterized in that a vehicle travel supporting information is an alarm or an instruction to operate an automatic brake when detecting a short distance from another vehicle.

3. A vehicle travel aiding device according to Claim 1, characterized in that a vehicle travel supporting information is an alarm or an instruction to operate an automatic brake when detecting an obstruction.

4. A vehicle travel aiding device according to Claim 1, characterized in that a vehicle travel supporting information is an information for guiding the vehicle to travel.

5. A vehicle travel aiding device for sensing running conditions of a vehicle and aiding the vehicle to travel, comprising means for detecting an operation mode of a light switch and control means for changing a content of support according to the detected operation mode of the light switch.

6. A vehicle travel aiding device for sensing running conditions of a vehicle and outputting a vehicle travel supporting information, comprising means for detecting an operation mode of a wiper and control means for changing a timing of outputting the travel supporting information according to the detected operation mode of the wiper.

7. A vehicle travel aiding device according to Claim 6, characterized in that a vehicle travel supporting information is an alarm or an instruction to operate an automatic brake when detecting a short distance from another vehicle.

8. A vehicle travel aiding device according to Claim 6, characterized in that a vehicle travel supporting information is an alarm or an instruction to operate an automatic brake when detecting an obstruction.

9. A vehicle travel aiding device according to Claim 6, characterized in that a vehicle travel supporting information is an information for guiding the vehicle to travel.

10. A vehicle travel aiding device for sensing running conditions of a vehicle and aiding the vehicle to travel, comprising means for detecting an operation mode of a wiper and control means for changing a content of support according to the detected operation mode of the wiper.

11. A vehicle travel aiding device for sensing running conditions of a vehicle and outputting a vehicle travel supporting information, comprising means for detecting a driver's operation which is an object to be supported, means for judging a driver's operation response by measuring a time interval from a moment of issuing an supporting information to a moment of detecting the operation performed, means for detecting circumstances for the vehicle and means for changing a timing of outputting the travel supporting information according to the judged response of the driver's operation and the detected circumstances.

12. A vehicle travel aiding device according to Claim 11, characterized in that a vehicle travel supporting information is an alarm when detecting a short distance from another vehicle and a driver's operation is an operation of an automatic brake or an accelerator.

13. A vehicle travel aiding device according to Claim 11, characterized in that a vehicle travel supporting information is an alarm when detecting an obstruction and a driver's operation is an operation of an automatic brake or an accelerator.

14. A vehicle travel aiding device according to Claim 11, characterized in that the means for detecting circumstances for the vehicle are means for detecting a wiper operation mode.

15. A vehicle travel aiding device according to Claim 11, characterized in that the means for detecting circumstances for the vehicle are means for detecting a light switch operation mode.

16. A vehicle travel aiding device for sensing running conditions of a vehicle and outputting a vehicle travel supporting information, comprising means for detecting a driver's operation which is an object to be supported, means for judging a driver's operation response by measuring a time interval from a moment of issuing an supporting information to a moment of detecting the operation performed, means for detecting road conditions for the vehicle and means for changing a timing of outputting the travel supporting information according to the judged response of the driver's operation and the detected road conditions.

17. A vehicle travel aiding device according to Claim 16, characterized in that a vehicle travel supporting information is an alarm when detecting a short distance from another vehicle and a driver's operation is an operation of an automatic brake or an accelerator.

18. A vehicle travel aiding device according to Claim 16, characterized in that a vehicle travel supporting information is an alarm when detecting an obstruction and a driver's operation is an operation of an automatic brake or an accelerator.

19. A vehicle travel aiding device according to Claim 16, characterized in that the means for detecting road conditions for the vehicle are means for detecting that an average running speed is higher than a threshold value.

20. A vehicle travel aiding device according to Claim 16, characterized in that the means for detecting road conditions for the vehicle are means for detecting that a frequency of braking operations for a specified period is higher than a threshold value.

21. A vehicle travel aiding device for sensing running conditions of a vehicle and outputting a vehicle travel supporting information, comprising means for detecting circumstances for the vehicle, means for detecting road conditions for the vehicle and means for changing a timing of outputting the travel supporting information according to the detected circumstances and road conditions for the vehicle.

22. A vehicle travel aiding device according to Claim 21, characterized in that a vehicle travel supporting information is an alarm and an instruction to operate an automatic brake or an instruction to control an engine output when detecting a short distance from another vehicle.

23. A vehicle travel aiding device according to Claim 21, characterized in that a vehicle travel supporting information is an alarm and an instruction to operate an automatic brake or an instruction to control an engine output when detecting an obstruction.

24. A vehicle travel aiding device according to Claim 21, characterized in that a vehicle travel supporting information is an information for guiding the vehicle to travel.

25. A vehicle travel aiding device according to Claim 21, characterized in that the means for detecting circumstances for the vehicle are means for detecting an operation mode of a wiper switch.

26. A vehicle travel aiding device according to Claim 21, characterized in that the means for detecting circumstances for the vehicle are means for detecting an operation mode of a light switch.

27. A vehicle travel aiding device according to Claim 21, characterized in that the means for detecting circumstances for the vehicle are means for detecting that an average running speed is higher than a threshold value.

28. A vehicle travel aiding device according to Claim 21, characterized in that the means for detecting circumstances for the vehicle are means for detecting that a frequency of braking operations for a specified period is higher than a threshold value.

FIG. 1

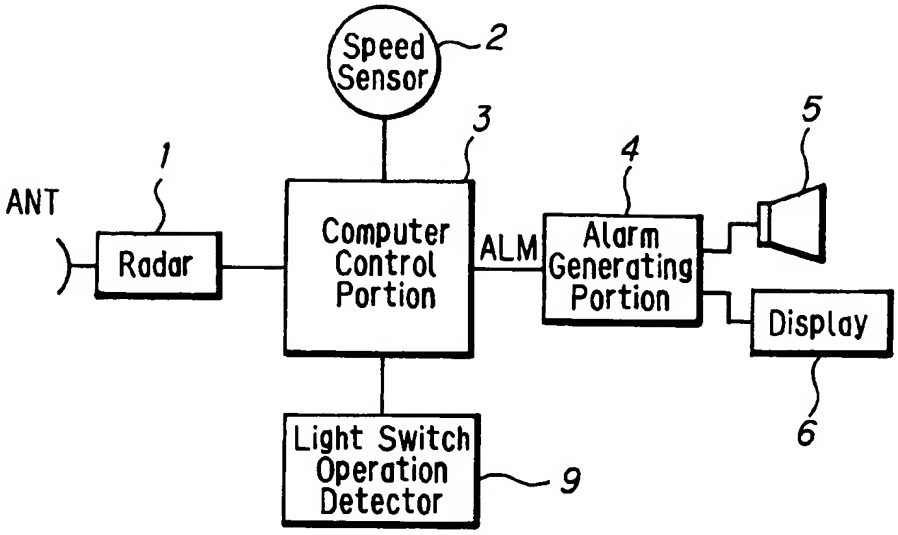

Speed Sensor
2
3
5
1
4
ANT
Radar
Computer Control Portion
ALM
Alarm Generating Portion
Display
6
Light Switch Operation Detector
9

FIG. 2

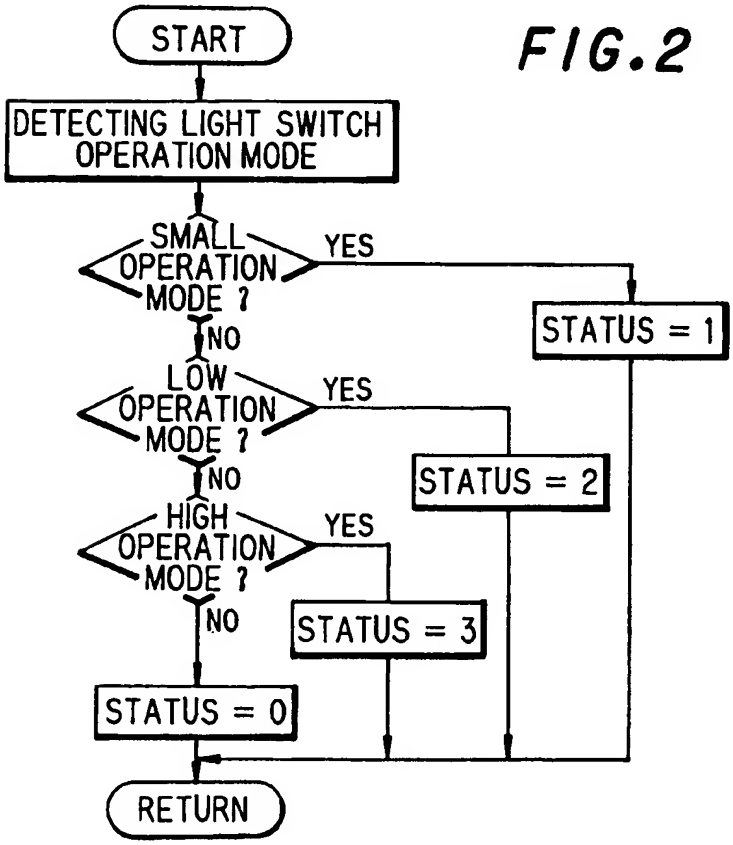

START
DETECTING LIGHT SWITCH OPERATION MODE
SMALL OPERATION MODE ?
YES
NO
STATUS = 1
LOW OPERATION MODE ?
YES
NO
STATUS = 2
HIGH OPERATION MODE ?
YES
NO
STATUS = 3
STATUS = 0
RETURN

FIG.3

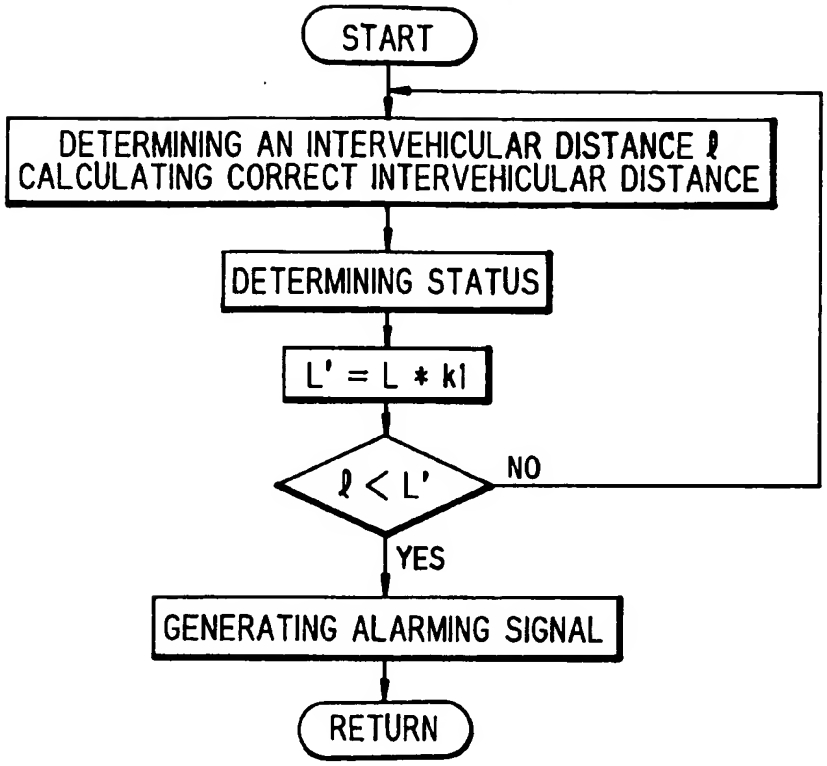

START
DETERMINING AN INTERVEHICULAR DISTANCE ℓ
CALCULATING CORRECT INTERVEHICULAR DISTANCE
DETERMINING STATUS
L' = L * k1
ℓ < L'
NO
YES
GENERATING ALARMING SIGNAL
RETURN

FIG.4

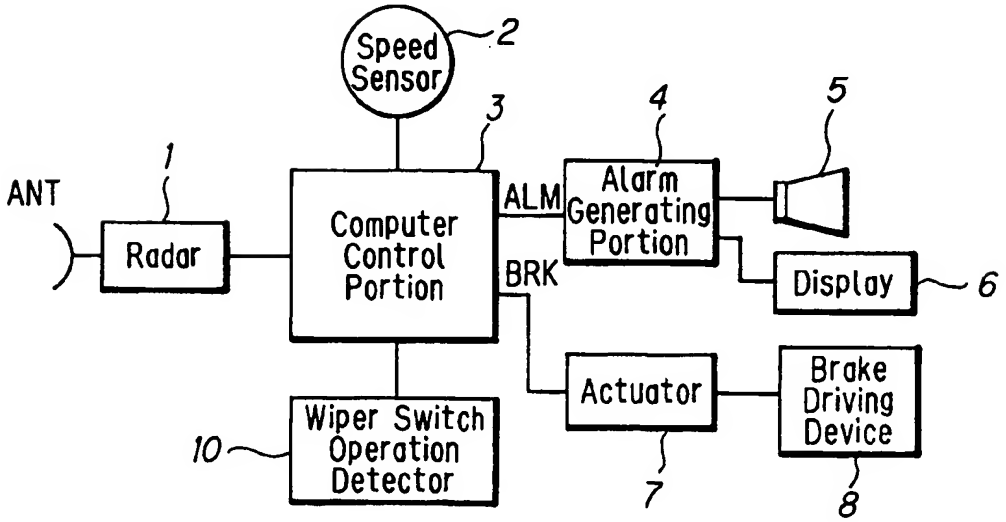

Speed Sensor
2
3
4
5
1
ANT
Radar
Computer Control Portion
ALM
BRK
Alarm Generating Portion
Display
6
Actuator
Brake Driving Device
Wiper Switch Operation Detector
10
7
8

FIG.5

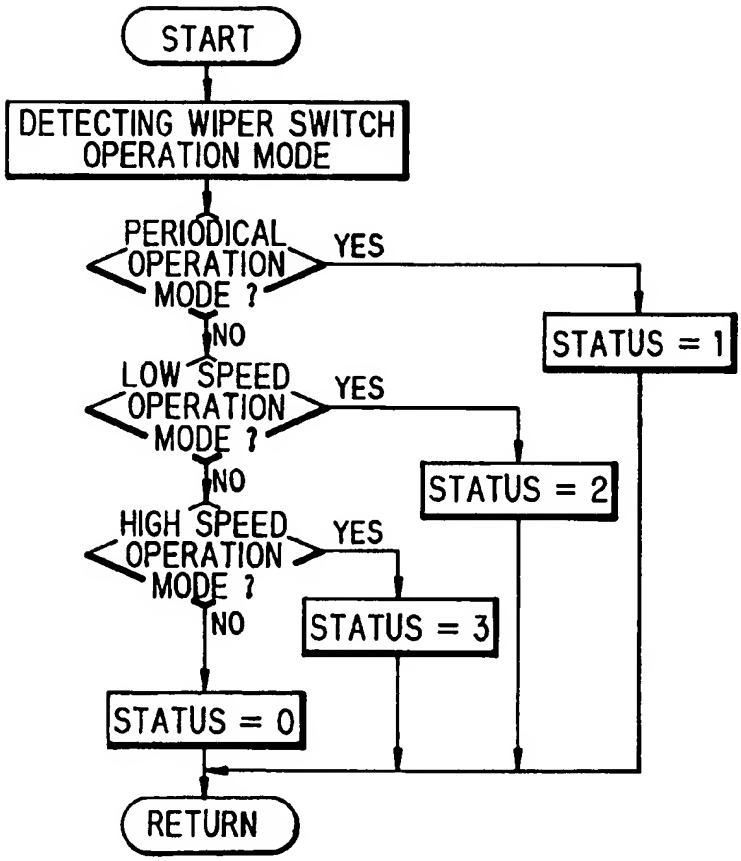

START
DETECTING WIPER SWITCH OPERATION MODE
PERIODICAL OPERATION MODE ?
YES
NO
STATUS = 1
LOW SPEED OPERATION MODE ?
YES
NO
STATUS = 2
HIGH SPEED OPERATION MODE ?
YES
NO
STATUS = 3
STATUS = 0
RETURN

FIG.6

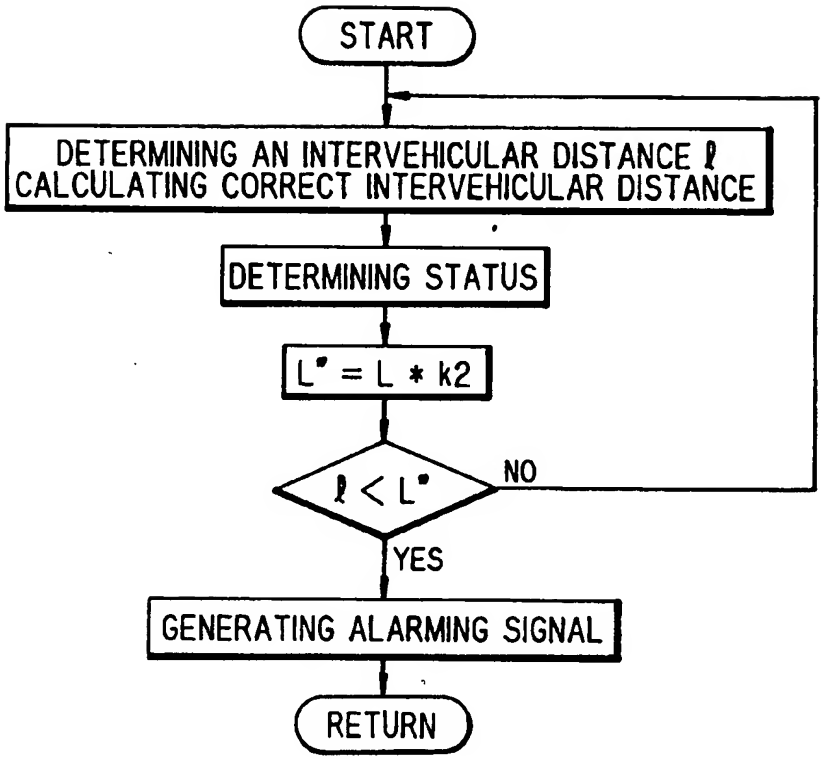

START
DETERMINING AN INTERVEHICULAR DISTANCE ℓ
CALCULATING CORRECT INTERVEHICULAR DISTANCE
DETERMINING STATUS
L* = L * k2
ℓ < L*
NO
YES
GENERATING ALARMING SIGNAL
RETURN

FIG. 7

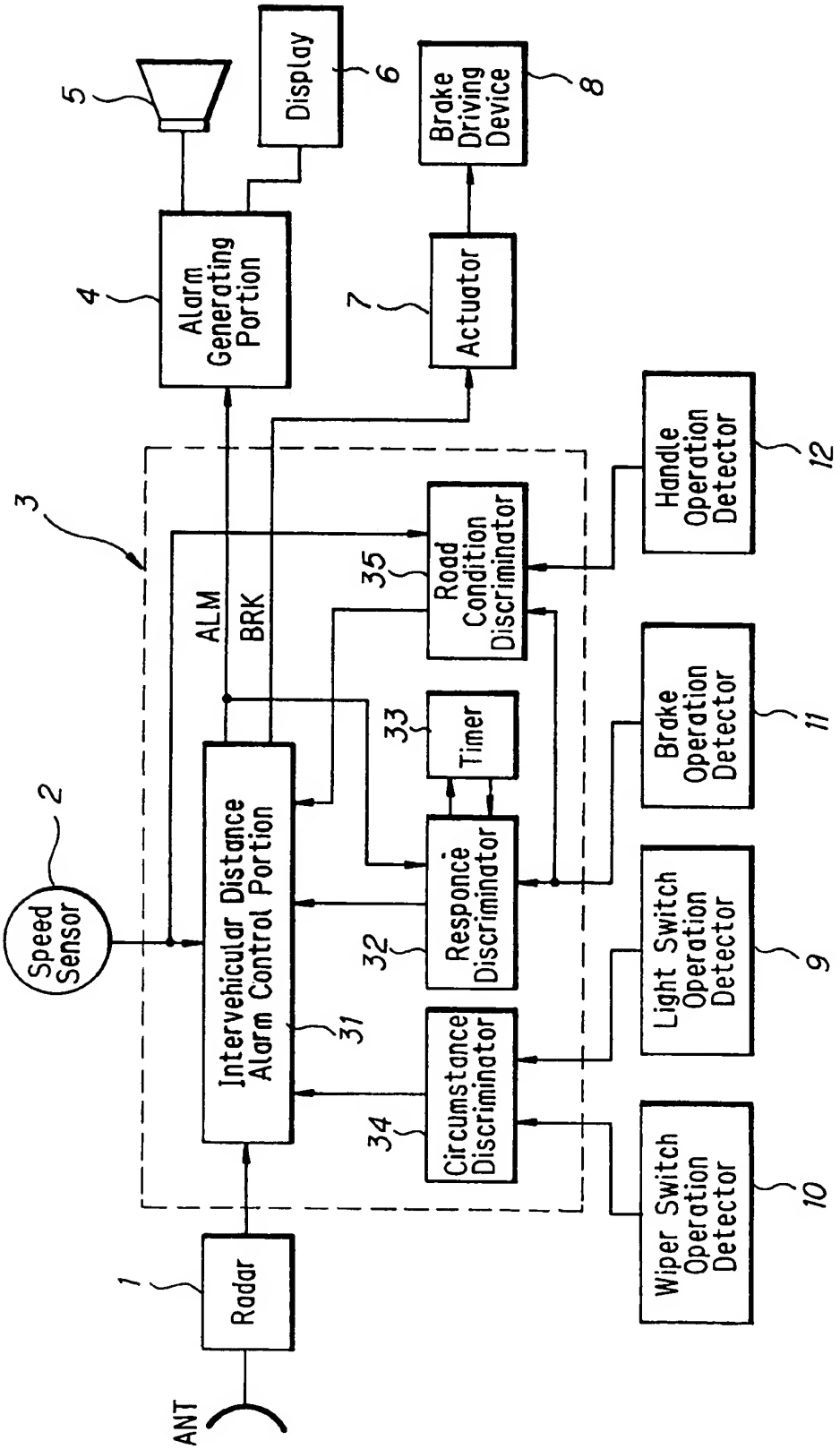
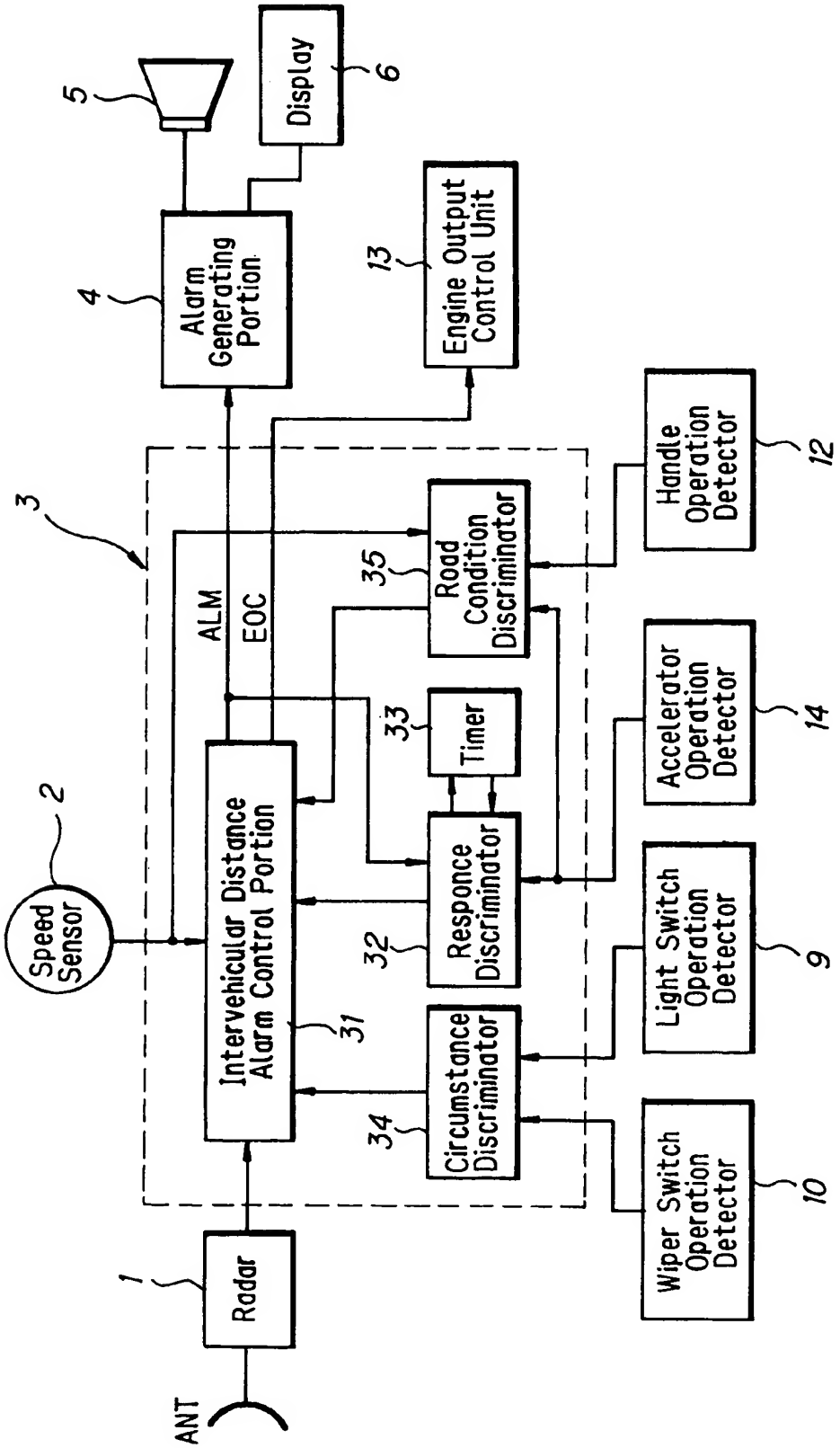

ANT
Radar
1
Speed Sensor
2
3
Intervehicular Distance Alarm Control Portion
31
Responce Discriminator
32
Timer
33
Circumstance Discriminator
34
Road Condition Discriminator
35
ALM
BRK
Alarm Generating Portion
4
5
Display
6
Actuator
7
Brake Driving Device
8
Light Switch Operation Detector
9
Wiper Switch Operation Detector
10
Brake Operation Detector
11
Handle Operation Detector
12

FIG. 8


ANT
Radar
1
Speed Sensor
2
3
Intervehicular Distance Alarm Control Portion
31
Circumstance Discriminator
34
Responce Discriminator
32
Timer
33
Road Condition Discriminator
35
ALM
EOC
Alarm Generating Portion
4
5
Display
6
Engine Output Control Unit
13
Handle Operation Detector
12
Accelerator Operation Detector
14
Light Switch Operation Detector
9
Wiper Switch Operation Detector
10